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Andrew Barker

Almost all Greek writings in harmonic theory include an account of the difference between two ways in which the sound of the human voice can move from one pitch to another in the course of an utterance. One form of this movement is called «divided» or «intervallic», διωρισμένη or διαστηματική, and the other is «continuous», συνεχής. The former is said to be that used in singing and is described as μελωδική; the latter, «continuous» movement, is correspondingly described as λογική; it is the kind which people – or at any rate Greek people – use when they speak. The earliest surviving discussion of the distinction is in a well known passage of Aristoxenus (*Aristox. Harm.* 8, 13-10, 20 Meibom = 13, 7-15, 12 Da Rios), and almost all later accounts – of which there are at least a dozen – are directly or indirectly dependent on it. Most of them are much shorter, and sometimes their brief paraphrases introduce ideas that do not come from Aristoxenus himself; I shall draw attention to some of them later in this paper. In a few cases they make assertions which Aristoxenus would certainly have denied. But even when their authors have deliberately or accidentally modified his position, their descent from an Aristoxenian original is usually obvious. This is true even of the version offered by Nicomachus in *Harm.* 2, which he mistakenly or mendaciously attributes to the Pythagoreans, and which someone – whether Nicomachus himself or his source – has indeed transposed into terms more appropriate to the Pythagorean style of harmonic theory¹.

¹ It is possible that the misattribution arose from an honest mistake. When Porphyry (*Harm.* 56, 5-57, 27) quotes the excerpt from Archytas which we know as his fr. 1, he says that Archytas preceded its final sentence with some remarks, which he does not quote, about the fact that the movement of the voice is διαστηματική – referring, presumably, to the voice's movement when it sings. We know nothing about this discussion; but if Nicomachus or his source knew of its existence, and if he found the Aristoxenian version

Most modern studies of the distinction drawn by the musical theorists have concentrated, for good reasons, on their treatment of the «intervallic» movement of the singing voice, which is also the way in which the sound of an instrument travels between the notes of a musical melody. In this paper I shall focus on the other term of the distinction, the «continuous» form of movement that is used in speech. Taking my cue from a difficult and fascinating passage in Porphyry's commentary on Ptolemy's *Harmonics*, I shall argue that we should pay serious attention to one of the ways in which Aristoxenus' account is commonly modified in the later sources. So far as I know, modern scholars have generally overlooked or ignored it; but there are some reasons for thinking that it has not crept into the tradition accidentally, and that it may give us different guidance from that of Aristoxenus on the mode of delivery used in spoken Greek.

But we must of course begin with Aristoxenus. When we sing, he tells us, and the voice's movement is intervallic, we make each pitch stable and clear and remain on it for some length of time; and when the voice moves to another pitch it does so instantaneously and in silence, touching on none of the pitches in between. In the continuous form of movement used in speech, by contrast,

the voice seems to perception to travel across some range of pitch in such a way as to stand still nowhere, not even on the boundaries themselves, at least according to the way it appears to perception, but to travel continuously until it falls silent [...] Summarily, then, when the voice moves in such a way that it seems to our hearing to stand still nowhere, we call this form of movement 'continuous'. [...] We call the continuous kind of movement λογική, for when we talk the voice moves in the dimension of pitch in such a way that it appears to stand still nowhere. [...] Hence we avoid bringing the voice to a standstill when we speak, unless a πάθος [which might be either a bodily affliction or an emotion] sometimes forces us into movement of this sort.

κατὰ μὲν οὖν τὴν συνεχῇ τόπον τινὰ διεξίεναι φαίνεται ἡ φωνὴ τῇ αἰσθήσει οὕτως ὡς ἂν μηδαμοῦ ἰσταμένη μὴδ' ἐπ' αὐτῶν τῶν περάτων κατὰ γε τὴν τῆς αἰσθήσεως φαντασίαν, ἀλλὰ φερομένη συνεχῶς μέχρι σιωπῆς. [...] ἀπλῶς γὰρ ὅταν μὲν

which he uses in a work which gave no indication of its origin, he might have assumed, wrongly but blamelessly, that it had emerged from the Pythagorean tradition which Archytas represented.

οὕτω κινήται ἡ φωνὴ ὥστε μηδαμοῦ δοκεῖν ἴσασθαι τῇ ἀκοῇ, συνεχῇ λέγομεν ταύτην τὴν κίνησιν. [...] τὴν μὲν οὖν συνεχῇ λογικὴν εἶναι φαμεν, διαλεγομένων γὰρ ἡμῶν οὕτως ἡ φωνὴ κινεῖται κατὰ τόπον ὥστε μηδαμοῦ δοκεῖν ἴσασθαι. [...] διόπερ ἐν τῷ διαλέγεσθαι φεύγομεν τὸ ἰσάναι τὴν φωνήν, ἂν μὴ διὰ πάθος ποτὲ εἰς τοιαύτην κίνησιν ἀναγκασθῶμεν ἐλθεῖν².

The repeated allusions here to «appearance» and «seeming» are not intended to suggest that the description being offered is unreliable. They are designed to emphasize the fact that Aristoxenus concerns himself only with the phenomena presented to sense-perception, and is uninterested in the physicists' speculations about the unperceived material events and processes which – so they claim – underlie them. This fundamental Aristoxenian perspective presents us with no immediate problems, since what we shall be exploring is precisely the way in which spoken Greek was heard, and not the physical and physiological processes involved in its production. Once that issue has been put on one side the picture Aristoxenus presents seems perfectly clear. When we speak, our voice moves up and down in the τόπος, the dimension or «space», of pitch; and in doing so it never stops moving, never pauses on any one stable pitch; our ears cannot even identify the pitches from which it begins and on which it ends. It is, we might say, a continuous glissando, slithering over the range which it inhabits so smoothly that we can detect no individual point of pitch at which any part of it is uttered.

Let us now leap forward six hundred years or so, to the third century AD. In his commentary on Ptolemy's *Harmonics*, Porphyry includes two quite different discussions of the distinction between intervallic and continuous vocal movement. In the first, at *Harm.* 9, 34-10, 27³, he presents an account which he attributes to the Aristoxenians, though it differs in significant respects from that of Aristoxenus himself; I shall mention it again briefly at the end of this paper. In the second, of which the part that concerns us is at 83, 1-84, 29, he is discussing and expanding the statements on the subject which he finds in Ptolemy's treatise. Both

² Excerpted from ARISTOX. *Harm.* 8, 19-9, 34.

³ Passages of PTOL. *Harm.* are cited by the page and line numbers of I. DÜRING, *Die Harmonielehre des Klaudios Ptolemaios*, Göteborg 1930, and those of PORPH. in *Harm.* by page and line numbers of I. DÜRING, *Porphyrios Kommentar zur Harmonielehre des Ptolemaios*, Göteborg 1932.

passages have surprising features which deserve discussion, but I want to concentrate on the second, which seems to record Porphyry's own views, as well as his interpretation of the rather brief and ambiguous remarks that Ptolemy devotes to the topic (*Harm.* 10, 5-11).

Just before the passages in the *Harmonics* and the commentary begin, Ptolemy and Porphyry have drawn a distinction between sounds that maintain the same pitch throughout, which they call ἰσοτόνοι φθόγγοι, «equal-toned sounds», and those whose pitch changes in the course of their duration; these are «unequal-toned», ἀνισότονοι. Their main topic here is of course the ἀνισότονοι, though equal-toned sounds will also play a part in their discussions. Some unequal-toned sounds are «divided», διωρισμένοι, in the sense that they consist of sequences of segments each of which is set firmly on a distinguishable pitch, and is separated by some definite distance in pitch from the parts of the sound that immediately precede and follow it. Unequal-toned sounds which are not divided in this way are continuous, συνεχεῖς ἀνισότονοι φθόγγοι, and both Ptolemy and Porphyry say, like other Greek writers, that they are useless for musical purposes. Porphyry nevertheless sets off on a substantial discussion of them, with the purpose, he says, of deciding whether the definitions that have been proposed for them are correct or not: ἐὰν τοίνυν αὐτοὺς ἐμφανίσωμεν οἵτινές εἰσι, τότε καὶ τοὺς ὅρους αὐτῶν εἰσόμεθα, εἰ ὀρθῶς ἀποδεδόνται, «if we show clearly which these are, then we shall know whether their definitions have been correctly stated» (83, 15-17). By «showing clearly» or perhaps «displaying» which these are, I think he means that he will pick out some examples on which everyone can agree, and that the adequacy of the definitions can be assessed if we consider how well they fit with these instances. Examples, at any rate, make up the bulk of the paragraphs that follow; some of them are borrowed from Ptolemy and some are not, and they are developed in much greater detail than Ptolemy had provided. We need to see what we can make of them.

The first, together with a brief preliminary statement, is as follows.

ἀνισότονοι γάρ εἰσι συνεχεῖς ψόφοι, ὧν οὐχ ὁμοία γίνεται οὐδ' ἴση ἡ τάσις, οὐδ' ὁμοιομερής, οἷος ὁ τῶν τυπτομένων χαλκωμάτων ψόφος καὶ ὁ τῶν σαλπίγγων τῶν ὠρολογίων ἦχος. ταῦτα γὰρ ἀρχόμενα κατ' ὀλίγον ἐπαναβαίνει καὶ συνεχῶς καὶ κατ' ὀλίγον ἐπιτεινόμενα ἕτερα καὶ ἕτερα, καὶ ἐτέραν ποιεῖται τάσιν, συνεχῇ μέντοι. ἀνερχόμενα⁴ δὲ ἐφ' ἣν πέφυκεν ἄρχεσθαι, πάλιν ἐκ τοῦ κατ' ὀλίγον

⁴ Here I adopt Alexanderson's emendation ἀνερχόμενα for the MSS ἀρχόμενα (B).

ὑποβαίνοντα μνουρίζεται, καὶ πρὸς τὸν βαρύτερον ἀφικνούμενα τόπον οἶονεἰ καθ' ὑπέκλυσιν μόγις ἀποσιωπᾶ.

Unequal-toned continuous sounds are those whose pitch is not all alike or equal⁵, and is not constituted of parts that are alike, such as the sound of pieces of bronze when they are beaten, and the noise of the trumpets that sound the hours. For when these are beginning they gradually ascend, and as they become continuously higher-pitched, little by little, they become different and different again, and make the pitch different but nevertheless continuous. And when they are returning towards their natural starting-point, they gradually tail away as they descend again, and when they arrive in the lower region they become feebler, as it were, and slide wearily into silence (83, 17-24).

So far as I know this is the only description we have of the sound of these 'trumpets' (σάλπιγγες) associated with clocks; according to Vitruvius, who calls them *bucinae*, they were water-powered devices invented by Ctesibius of Alexandria, who also invented the *hydraulis* or «water organ». They evidently made a sound rather like that of an air-raid siren, or the sirens used to signal the end of a shift in 20th-century factories. I suppose that the sound began when water was released into a reservoir, forcing air out through a tube into the instrument, and that the water flowed into the reservoir more quickly than the corresponding amount of air could escape, so increasing the wind-pressure and progressively raising the pitch. When the flow of water was decreased and eventually turned off, the sound would continue for a time, but as the air escaped the pressure would become gradually less, the pitch would slide downwards and the sound, as Porphyry says, would gradually tail away.

At all events, the description that Porphyry provides seems to fit perfectly the picture of a continuously moving sound that Aristoxenus had painted.

ALEXANDERSON, *Textual Remarks on Ptolemy's Harmonics and Porphyry's Commentary*, Göteborg 1969).

⁵ Porphyry says «not all alike» (ὁμοία) as well as «not equal» (ἴση), because he has argued at length in his discussion of PTOL. *Harm.* I.3 that pitch is not a quantitative attribute, as Ptolemy supposed, but a quality, and qualities cannot properly be described as «equal», a term that applies only to quantities. He uses the adjective ὁμοιομερής («constituted of parts that are alike») for the same reason, while continuing also to deploy terms with quantitative implications – ἴσος, ἰσότονος, ἀνισότονος and so on – out of deference to Ptolemy's usage. See 82, 26-32.

He appears to be describing a smooth glissando including no periods of time during which the pitch is stable. Both its ascent and its descent are uninterrupted and continuous, and Porphyry gives no indication that the sound ever remains poised on a steady pitch, however briefly, even in the moment when it has reached its peak and is about to start falling.

The second example follows immediately.

Κάπὶ τῶν ἄρτι δὲ μανθανόντων μελωδεῖν τὸ αὐτὸ συμβαίνει· προβαλλομένου γάρ τινα τάσιν τοῦ διδασκάλου καὶ κελεύσαντος ταύτην ὁμοίως προενέγκασθαι ὁ μανθάνων πειρώμενος μὲν ὁμοτονεῖν, οὐ δυνάμενος δέ, προφέρεται τινα τάσιν βαρυτέραν τῆς δοθείσης καὶ ὀξυτέραν, καὶ λοιπὸν ἀντιλαμβανόμενος ἑαυτοῦ μὴ λήγοντος σιωπῆσαι μὲν αἰδεῖται, μένων δ' ἐν τῷ φωνῇ ἀφιέναι οἰοῖται διαψηλαφᾷ καὶ ζητεῖ πάντα τὸν σύνεγγυς τόπον τῆς ἐνδοθείσης τάσεως· καὶ βαρυτέρας μὲν τῆς ἰδίας προφορᾶς αἰσθῆσιν λαβὼν παροξύνει κατ' ὀλίγον αἰσθητὸν διάστημα μὴδ' ἐν ποιῶν· ὀξυτέρας δέ, βαρύνει πάλιν πρὸς ὀλίγον. ταῦτα δὲ ποιῶν συνεχῇ μὲν τὴν τάσιν τῆς φωνῆς ποιεῖ, ἐπὶ μίαν δὲ καὶ ὁμοίαν καὶ ἴσην τάσιν οὐκέτι, οὐδ' ἰσοτόνως.

The same thing happens with people who are just learning to sing. For when the teacher produces a particular pitch and tells them to produce it in the same way, the pupil who is trying to sing the same pitch, but cannot, produces some pitch lower than the one given, and a higher one; and then becoming aware of himself, without stopping, he is ashamed to fall silent, and while continuing to give voice he gropes about, as it were, and seeks out every region near the given pitch. When he perceives that his own utterance is too low he gradually sharpens it, without producing a single perceptible interval, and when he perceives that it is too high, he again gradually makes it lower. As he does these things he makes the pitch of the voice continuous, never equal-toned or settling on a pitch that is one and the same and equal (83, 25-84, 5).

Porphyry's account of a singing-student's embarrassing tribulations is so graphic that we may guess that he is recording his own childhood experience (whether it was he himself or a wretched fellow-student who found himself in this unfortunate situation). Strictly speaking, the first part of it seems irrelevant to the matter in hand; the pupil sings a pitch that is too low and then one that is too high, and Porphyry says nothing to suggest that these pitches are unstable, or that the singer slides from one to the other. He is merely setting the scene. The phenomenon of «continuous unequal-toned sound» makes its appearance in the next part

of the excerpt; the student «gropes about» (διαψηλαφᾷ) in the region of pitch near the required note, moving between pitches not by determinate steps but «gradually» or «little by little» (κατ' ὀλίγον) without passing in one bound across any identifiable interval. The pitch of his voice changes continuously; no part of the sound he produces is equal-toned, or settles on any steady pitch.

We seem, then, to be dealing once again with precisely the kind of sound that Aristoxenus described, and the case is even clearer in the third example, in which Porphyry expands an allusion made by Ptolemy.

Ἰδεῖν δ' ἐστὶ τοῦτο κάπὶ τῶν ἐντατῶν ὀργάνων, ἐφ' ὧν, ὅταν τις ἅμα τῷ πληξαί τινα χορδὴν εὐθὺς ἐπιτείνῃ, ποιεῖ φωνὴν κατὰ παρεξήγησιν ἐτέραν. σχεδὸν γὰρ τῆς πληγῆς ἔτι συνεχούσης τὸν φθόγγον ἐπακολουθήσασα καὶ ἡ ἐπίτασις ἢ ἄνεσις ὑποσύρει τοῦτον εἰς ἀπείρους καὶ συνεχεῖς τάσεις. ὃ δὴ ἔφη καὶ ὁ Πτολεμαῖος πεπονθέναι τοὺς ταῖς ἐπίτάσεσιν ἢ ταῖς ἀνέσεσιν κινουμέναις ἔτι συνηχοῦντας ψόφους.

One can see this also on stringed instruments, on which, when someone strikes a string and at the same time immediately tightens it, it makes a sound that becomes progressively different⁶. For while the impact is still making the note continuous, the subsequent tightening or slackening drags the note into an unlimited number of continuous pitches. This is what Ptolemy says is done to sounds by tightenings and slackenings that change while the sounds are still continuously resounding (84, 6-11).

The scenario here is perfectly clear; pluck a string on your violin or guitar while simultaneously turning the string's tuning-peg, and the pitch will vary continuously for as long as you go on continuously adjusting the tension of the string. No comment seems necessary. But shortly afterwards Porphyry's representation of a continuous unequal-toned sound changes in a surprising way. Up to this point he has not mentioned the definitions that Ptolemy gives. We were led to expect that the examples Porphyry has provided will cast light on their credentials, but in fact when he turns to

⁶ The word «progressively» is a guess at the sense of *kata parexēgēsīn*. The noun *parexēgēsis* appears elsewhere only in later writings, where it regularly refers to a written explication or interpretation of a text, and there seems to be no parallel to the usage involved here. The variant found in one group of MSS, *parexētēsis*, is otherwise unknown.

those definitions he appears to abandon the picture that emerged from the examples – or at least to modify it radically – and to commit himself (and by implication Ptolemy too) to a substantially different position.

Between the example I have just quoted and his treatment of Ptolemy's definitions, Porphyry inserts a short quotation from Aristoxenus, and a couple of lines of comment. They are apparently designed principally to explain what Ptolemy meant by the terms *ἐπίτασις*, «tightening», and *ἄνεσις*, «slackening», and we need not trouble ourselves with them here. This is how he continues.

ἔχουσι μὲν τοίνυν οἱ ἀνισότονοι ψόφοι μετάβασιν, ἀλλ' ἀνεπίδηλον ταύτην τῷ μὴ διορίζεσθαι τοὺς τόπους αὐτῆς, ὥστ' ὀρθῶς ἀπεδόθησαν “συνεχεῖς εἰσιν οἱ ἀνισότονοι ψόφοι, οἱ τοὺς τόπους τῶν ἐφ' ἐκάτερα μεταβάσεων ἀνεπιδήλους ἔχοντες”. ἔστι δὲ καὶ οὕτως αὐτοὺς ἀφορίσαι, “ὣν οὐδ' ὅτιοῦν μέρος ἰσότονόν ἐστιν ἐπὶ διάστασιν αἰσθητήν”. μέρος μὲν γάρ τί ἐστιν ἐν αὐτοῖς ἰσότονον, ἀλλ' ἄχρι τινός, μέρος δ' ἀνισότονον, οὐ μὴν ἐπιδηλώσει ἂν οὐ συνεχῆς ὁ ψόφος ἀλλὰ διωρισμένος, διελημμένων αὐτοῦ τῶν τάσεων τοῖς ἐπιδήλοις πέρασιν. ὥπερ οὖν ἐπὶ τῆς ἱρίδος τὸ πρασίζον χρῶμα καὶ τὸ χρυσίζον καὶ ἐρυθρόν ἄχρι μὲν τινος ὅμοιον θεωρεῖται, ἀνεπίδηλον δὲ τὸ πέρας ἐκάστου καὶ συγκέχυται ἀκαταλήπτως τῇ αἰσθήσει· οὕτως ἐπὶ τῶν ἀνισοτόνων συνεχῶν ψόφων ἔχει· καὶ τάλλα δ' ἃ παρείληφε παραδείγματα εἰσηγησόμεθα.

Unequal-toned sounds, then, do make transitions, but they are imperceptible because their locations are not distinctly defined. Thus it is rightly said that unequal-toned continuous sounds are «those the locations of whose movements in each direction are not clearly apparent». It is possible also to define them in this way, as those «of which no single part is equal-toned over a perceptible interval <of time>». For there is in them a part which is equal-toned, but only up to some point, and a part which is unequal-toned, but a sound would not make this apparent if it were not continuous but discontinuous, with pitches separated by clearly apparent boundaries. Thus just as in the rainbow the green colour and the golden and the red are seen as the same up to some point, but the boundary of each is not clearly apparent and is blurred in a way that perception cannot grasp, so it is with unequal-toned continuous sounds (84, 18-28).

Two definitions of continuous unequal-toned sounds are quoted in this passage. Such sounds are «those the locations of whose movements in each direction are not clearly apparent», and they are, alternatively, those «of which no single part is equal-toned over a perceptible interval

<of time>». The definitions come from Ptolemy, who presents them in these words, side by side, at *Harm.* 10, 6-8; and both writers apparently find both the definitions equally acceptable. We can deal quickly with the second, which Porphyry does not discuss at this point; he has, in effect, discussed it at length already, or has at any rate provided a number of examples which clearly exemplify the kind of sound it describes. As the definition says, and as we have seen from the examples, no part of such a sound stays on the same pitch for any detectable period of time.

None of the cases that Porphyry has provided, however, seem clearly to exemplify the first of Ptolemy's definitions, and it has not yet been discussed. But it is very different from the second. It describes the relevant sounds as «those the locations of whose movements in each direction are not clearly apparent». This definition says nothing about the sound's attributes over the whole extent of its span of life, only about the stretches of it in which it is moving upwards or downwards in pitch. Part of Porphyry's explication of it comes in the first sentence of the excerpt, before he quotes the definition itself. «Unequal-toned sounds, then, do make transitions [ἔχουσι ... μετάβασιν, literally «have transition»], but they are imperceptible because their locations are not clearly defined». But the fact that these transitions are blurred and we cannot tell exactly where they begin and end has no implications about any parts of the sound that are not transitions. The definition can apply perfectly well to a sound of which some parts stay at a steady pitch, but slide away at their edges towards other pitches in the way that the definition describes. Its equal-toned parts might or not be perceptible as such; in either case it will fit the definition.

Thus Ptolemy's two definitions are evidently not equivalent to one another. Before we consider how they might be related, let us review the rest of what Porphyry says in this passage. He immediately spells out the point I have just made – more positively, in fact, than I have. In such sounds there *is* – «is», not merely «may be» – a part that is equal-toned. But, he goes on, it is equal-toned only ἄχρι τινός, a phrase which in this context is almost impossible to put into an English form that is not misleading. We can usually translate ἄχρι τινός or μέχρι τινός as «up to a certain point»; but that will not do here; we know that in this kind of case the location in question is neither certain nor a point. We cannot even say «up to some point or other», since there is no determinate point at which this part of the sound ends. Perhaps we could use something like «only for a while» as a tolerable paraphrase of Porphyry's expression. But that's only a problem for a translator. The most significant part of Porphyry's statement is simply

its assertion that some parts of these continuous sounds are equal-toned; during some temporal stretches of their existence they stay steadily on a single pitch.

Porphyry comments next on the unequal-toned parts of the sound, the phases in which they exhibit μεταβάσεις, transitions between different levels of pitch. This part of his sentence is rather convoluted and it's possible that the text is corrupt; but after some useful discussions with Massimo Raffa I have come to the conclusion that the received text is acceptable and can be coherently interpreted. What Porphyry means is that the unequal-toned part of a sound will only impress itself on the ear if the sound is continuous, not if it is discontinuous and moves by clean-cut leaps from one well-defined point of pitch to another. A sound of this latter sort, taken as a whole, is unequal-toned, but every audible part of it is equal-toned; between these determinate pitches there is nothing to be heard, and so, as Porphyry puts it, the sound would not make any unequal-toned part apparent.

But for our purposes that is a side-issue. Let us return to continuous sounds, as they are portrayed in Ptolemy's first definition: continuous sounds of unequal pitch are «those the locations of whose movements in each direction are not clearly apparent». We should notice at this stage that Porphyry has not so far told us whether the equal-toned parts of such sounds can or cannot be perceived *as* equal-toned; but some indication of his view on that question – which will turn out to be very important – can be extracted from the last sentence of the extract, in his treatment of the analogy of the rainbow.

The analogy comes from Ptolemy, but he says only that what occurs in the case of a continuous unequal-toned sound is «like what happens to the colours of the rainbow», ὅποιον πέπονθε τὰ τῆς ἱρίδος χρώματα (*Harm.* 10, 8). Since this remark appears immediately after his second definition, he seems to imply that none of the rainbow's colours remains the same over any perceptible distance across its width. But Porphyry's expansion of the analogy develops it in an entirely different direction, and he is clearly relating it not to Ptolemy's second definition but to his first. The green and the red parts of the rainbow, he says, «are *seen as* the same up to some point»; that is, the rainbow contains areas which our eyes can pick out, and which we perceive as being exactly the same colour throughout. «But», he goes on, «the boundary of each is not clearly apparent and is blurred in a way that perception cannot grasp». So there are regions within the rainbow throughout each of which the colour is the same and

which we perceive *as* being the same, but the colours in the areas between them shade hazily into one another, so that we cannot say of any part of them that it has some one specific colour. The important point is that it is *only* these borderlands between the identifiable colours that are confused and blurred. We cannot tell exactly where one such colour ends and the next begins, but there is no doubt about the identity and consistency of the colour that is bounded by any given pair of these indeterminate frontiers. And «so it is», he concludes, «with unequal-toned continuous sounds».

The evidence of my own eyes suggests that Porphyry is right about the rainbow; the main part of each of its stripes presents us with a consistent, identifiable colour, but each clearly coloured region shades off into the next in such a way that there is no sharp boundary between them. But if we apply this analogy to continuous sounds, they will evidently have quite different features from those described by Aristoxenus and by Ptolemy in his second definition, and exemplified in the earlier parts of Porphyry's discussion. Unlike the latter, they will include phases which maintain a steady pitch, and if what Porphyry says about the rainbow is a reliable guide, they will do so to an extent that our ears can detect. What distinguishes them from discontinuous unequal-toned sounds is only that there are no clearly marked boundaries between the phases in which they remain on stable and identifiable pitches. These pitches melt indeterminately into one another at the edges, like the rainbow's colours; and unlike those involved in a discontinuous or 'intervallic' sound, they are not separated by precise and sharply delineated borderlines. Quite obviously, then, if Ptolemy's first definition is developed in this way, it cannot apply also to the phenomena described by the second; a sound cannot both have *no* parts that are perceived as equal-toned, and move through confused phases of transition between parts which *are* perceptibly equal-toned.

How, then, are the two definitions related? Ptolemy does not discuss the matter; in fact he does not discuss his definitions at all. When he presents them he links them only with the single word ἢ, «or», and makes no attempt to spell out the relation between them any further. On the most natural interpretation, he is implying that the two definitions are equivalent to one another, so that his «or» can be read as meaning «or in other words». But if this is what he means he is badly mistaken, as we have seen; the definitions are neither logically equivalent, nor such that as a matter of empirical fact they pick out the same range of phenomena. One might suggest that Ptolemy meant something different, perhaps that every unequal-toned continuous sound must have the characteristics specified

in *both* definitions. But this will not do either. For one thing, it would make the first definition redundant; if a sound has no equal-toned parts, the locations of its movements up and down in pitch will necessarily be indeterminate. More conclusively, if that had been what Ptolemy intended, he would certainly have linked the two definitions with the connective *καί*, «and», instead of *ἢ*, «or».⁷ There seems to be just one other possibility, which is that Ptolemy recognised that the definitions apply to different though potentially overlapping classes of phenomenon, and thought of them as two distinct kinds of continuous unequal-toned sound, two species falling under a single genus. At a stretch, I think, his statement could be read in that way. We might think it odd that if he does mean to draw this distinction he says no more about it, since it is distinctly unusual; but perhaps it is not really very surprising, since Ptolemy mentions sounds of these sorts only in order to distinguish them from the «divided» sounds used in music, and has no interest in them for their own sake.

What about Porphyry? Like Ptolemy, he is most naturally understood as meaning that the two definitions apply to the same range of items; in fact he seems to imply this even more clearly than Ptolemy. After saying that the first definition is correct, he adds that «they», *αὐτούς*, which must be the sounds to which the first definition applies, can also be defined in the way expressed in the second. Unless he is expressing himself very carelessly, he must surely mean that both definitions are accurate and complete definitions of the same phenomenon. But in that case he is clearly wrong, for the reasons we have discussed. It is hard to see how his mode of expression could be made consistent with either of the other interpretations I suggested for Ptolemy's statement. Even if we could find a way of reading what he says that would allow him to be referring, intentionally, to two different kinds of phenomenon that are species of the same genus, it would be much more difficult than in Ptolemy's case to explain why he never makes the point explicitly or discusses it, since unlike Ptolemy he devotes a good deal of time and thought to the topic of these continuous sounds.

The representation of continuous unequal-toned sounds which we find here is so unfamiliar and so different from the Aristoxenian one, to which

⁷ But I must concede that *ἢ* and *καί* are often confused in manuscripts: see J. DIGGLE, *Studies on the Text of Euripides*, Oxford 1981, p. 27 and *Euripidea. Collected Essays*, Oxford 1994, p. 198. I am grateful to an anonymous reviewer for these references.

Porphry also seemed to subscribe in the earlier parts of his discussion, that we might easily refuse to take it seriously. Perhaps Ptolemy was writing rather carelessly on a topic which did not really concern him. Porphry adds important points to what Ptolemy had said, asserting, as Ptolemy does not, that continuous unequal-toned sounds have some equal-toned parts, and implying through the analogy of the rainbow that the steady pitches of these parts can be detected by the ear. We might easily imagine that he became so intrigued with his reflections on the appearance of rainbows that he incautiously allowed them to lure him a little way down a misleading path; and in that case we would expect him to rejoin the main track quite soon, perhaps without even noticing that he had left it. The allusion to the rainbow is after all only an analogy, and Ptolemy, who suggested it, does not specify which attributes of a continuous sound correspond exactly to those of its visible analogue, and which of them do not.

But we should not treat Porphry's representation so lightly, and not only because he is not usually so casual in his treatment of analogies; that would not be a secure indication, since everyone who writes as much as Porphry did will make uncharacteristic mistakes from time to time. There is much clearer evidence, a couple of pages further on in the text, that he means what he has said; continuous unequal-toned sounds do indeed, or at least may sometimes, have parts that are equal-toned and which can be perceived as maintaining a steady pitch. The passage in question is at 87, 1-13, and it also brings us back explicitly to issues about the way in which the Greek language was spoken.

Porphry is discussing the ways in which Ptolemy's definition of a φθόγγος, a musical note, differs from those given by the Aristoxenians. He points out that Ptolemy replaces the Aristoxenians' reference to φωνή, «voice», with the more general term ψόφος, «sound», a change of which he approves. Secondly, he comments that Ptolemy does not write, as the Aristoxenians do, of the incidence of a voice or sound ἐν μιᾷ τάσει, «on a single pitch», but of the sound as «maintaining one and the same tone», ἕνα καὶ τὸν αὐτὸν ἐπέχειν τόνον, adding the explanatory point, as he has also in an earlier passage, that Ptolemy is using the term τόνοϛ, «tone», in the sense in which it is equivalent to τάσιϛ, «pitch» (87, 7-9).

What Ptolemy means, then, is that a φθόγγος is to be defined as a sound that maintains one and the same pitch, from which it follows that any sound which maintains one and the same pitch can properly be regarded as a φθόγγος, a musical note. But Porphry raises an objection. «It will appear», he says, «that the definition which Ptolemy has expressed is not

accurate, because it includes also the parts of a continuous vocal utterance and of simple sounds that are not produced melodically» (δόξει δὲ μὴ εἶναι ἀκριβὴς ὁ ὑπὸ τοῦ Πτολεμαίου ἀποδοθεὶς ὅρος τῷ προσπεριλαμβάνειν καὶ τῆς συνεχοῦς φωνῆς καὶ τῶν ἀπλῶν καὶ μὴ μελωδομένων ψόφων τὰ μέρη, 87, 9-11). Clearly he is taking the view that at least some non-musical sounds made by things other than the human voice have parts that «maintain one and the same pitch», and also, most importantly, that some parts of a continuous vocal utterance (a συνεχῆς φωνή) will do so too. None of these parts, he implies, can be described as a note, and hence Ptolemy's definition fails because it includes too much.

His next sentence, designed to confirm the point he is making, leaves no room for doubt that when he refers to a «continuous vocal utterance» he is referring to human speech. «For it is possible», he says, «to apply the description “being a sound that maintains one and the same tone” also to a high-pitched or a low-pitched syllable», ἐγχωρεῖ γὰρ καὶ ἐπὶ τῆς ὀξείας ἢ βαρείας συλλαβῆς τάττειν τὸ εἶναι ψόφον τὸν ἓνα καὶ τὸν αὐτὸν ἐπέχοντα τόνον» (87, 11-13). The picture painted here of the sound of speech corresponds precisely to the one that emerged in the discussion of the rainbow. Spoken words have parts that are equal-toned, maintaining one and the same pitch. These parts are identified as syllables, and each syllable must occupy enough time to make itself perceptible to our hearing. We may also note that Porphyry offers no argument to support his statement; he must assume that it is so obviously true that it needs no confirmation. That can be the case only if our hearing directly assures us that each syllable does indeed maintain a steady pitch, at least for a detectable part of its duration. For both these reasons it is impossible to escape from the conclusion we are reaching by arguing that the equal-toned parts of spoken words may be so brief as to be imperceptible. We cannot avoid concluding that Porphyry represents human speech as containing parts which by Ptolemy's definition would count as musical notes, parts that maintain a constant pitch for a perceptible period of time, even though they will shade into one another at the edges and so comprise parts of a continuous sound, not one that is intervallic or «divided». Its audible profile is therefore completely different from the one presented in Aristoxenus' seminal discussion of the matter.

At first sight there seem to be only three possible ways of explaining the disagreement. One is that we have misunderstood Aristoxenus, and that in fact he would agree with Porphyry about the way in which Greek

was spoken. The second is that one or the other of the two writers was simply wrong, and had not paid sufficient attention to the nature of the phenomenon they were describing. Thirdly, perhaps both of them are right, and Greek speech-patterns changed in the relevant way, at some time in the period between the 4th century BC and the 3rd century AD. In fact, however, these three hypotheses do not exhaust the possibilities; there is also a fourth. But I shall not try to explain what it is until we have considered the first three.

The first possibility can be ruled out immediately. We have not misunderstood Aristoxenus; he expresses himself unambiguously, and I shall not try to prove it by revisiting the passage I quoted from the *Elementa harmonica* earlier in this paper. Nor, unfortunately, can we be sure whether he was right or wrong, since we have no other texts from the same period which could tell us whether his contemporaries would have found his account acceptable. But in view of his repeated insistence that reliable conclusions in the field he is discussing can be reached only on the basis of very careful observations of the actual phenomena, we would have to be very sure of our ground if we wanted to accuse him of carelessness in this respect. There remains the possibility that Porphyry was mistaken, and the possibility that he and Aristoxenus were both right, which they could be if the way in which Greek was spoken had changed in the intervening centuries. Since we do have a good number of texts from the later period with which we can compare Porphyry's account, we may be able to make a reasonably confident guess about which – if either – of these possibilities is correct.

A very brief survey of relevant texts is all I can offer here, with a quick glance at half a dozen musical theorists – Cleonides, Nicomachus, Gaudentius, Bacchius, Aristides Quintilianus and the writer of the third of the anonymous essays first edited by Friedrich Bellermann in 1841. I shall also mention one literary theorist, Dionysius of Halicarnassus. Of the musical theorists, the anonymous writer can be dismissed immediately; the relevant passage in his treatise is just a patchwork of snippets quoted from Aristoxenus⁸, and there is no evidence that he had reconsidered them in the light of contemporary Greek usage.

Nicomachus is unhelpful for similar reasons⁹. Even the attempt that he

⁸ ANON. BELL. *De musica* 33–36.

⁹ NICOM. *Harm.* 2, 238, 18–240, 3 Jan.

or his source has made to transpose Aristoxenus' account into Pythagorean language fails to conceal the fact that it introduces no significant modifications to what Aristoxenus said on this issue. It is, in effect, merely a Pythagorean's translation of remarks in the *Elementa harmonica*. In this sense it is merely a scholarly or pseudo-scholarly record of what had been said in the past, and there is nothing to suggest that anyone in the train of transmission between Aristoxenus and Nicomachus had reflected critically on the content of the text they were retailing, or compared it either with their own observations or with what any other writers may have said on the subject. And I shall say nothing about Gaudentius, who dates, perhaps, from the 4th century AD. I confess that I rather like his little treatise, but technically speaking it is not a distinguished piece of work; and on this issue at least, what he produces is a distressingly incoherent muddle¹⁰.

Cleonides and Aristides Quintilianus are generally recognised as the most authoritative and reliable of the musical theorists on my list. Their descriptions of the continuous form of vocal movement which they associate with speech are brief and very similar to one another, but they will repay a few moments' examination. Neither of them can be dated precisely. The text attributed to Cleonides is probably the earlier, perhaps written in the 2nd century AD or even the 1st, and Aristides probably belongs to the 3rd century. The date of Bacchius, who also makes a useful contribution on this issue, is even harder to establish; we may guess that he was at work in the 3rd century or the 4th, but there are no clear indications to guide us.

Cleonides starts by saying, like Aristoxenus, that the voice has two forms of movement. «One of them», he goes on, «is called “continuous” and “proper to speech”, the other “intervallic” and “proper to melody”. Continuous movement of the voice makes its ascents and descents in a way that is obscure to perception, and stands still nowhere until it reaches silence»: ταῦτα δὲ θεωρεῖται ἐν φωνῆς ποιότητι, ἥς κινήσεις εἰσὶ δύο, ἡ μὲν συνεχῆς τε καὶ λογικὴ καλουμένη, ἡ δὲ διαστηματικὴ τε καὶ μελωδική. ἡ μὲν οὖν συνεχῆς κίνησις τῆς φωνῆς τὰς τε ἐπιτάσεις καὶ τὰς ἀνέσεις ἀφανῶς ποιεῖται, μηδαμοῦ ἰσταμένη ἢ μέχρι σιωπῆς (Cleonid. *Harm.* 2, 180, 11-16 Jan). The final part of the description of continuous vocal movement given in Cleonides' second sentence, that it «stands still nowhere until

¹⁰ GAUD. *Harm.* 1, 328, 1-16 Jan.

it reaches silence», comes directly from Aristoxenus. It encapsulates the whole of Aristoxenus' description of this kind of movement, and even echoes the wording of a sentence in the *Elementa harmonica*. But the first part does not. One might argue that Aristoxenus' account implies that these ascents and descents are in some sense ἀφανής, «obscure to perception»; the movement, according to Aristoxenus is *always* ascending or descending, and we could fairly easily work out a sense in which such movements will be «obscure». But he does not say that they are so; the notion of being obscure to perception does not in fact enter his discussion at all. The formulation and the idea it conveys have been attached to Aristoxenus' description by some later theorist.

This new element corresponds closely, though not quite exactly, to the first of Ptolemy's definitions, the one that Porphyry elaborates through his comments on the rainbow: unequal-toned continuous sounds are «those the locations of whose movements in each direction are not clearly apparent». There is no significant difference between Ptolemy's adjective ἀνεπιδήλους, «not clearly apparent», and Cleonides' adverb ἀφανώς, «obscurely to perception» or simply «unclearly». The only detail in which the statements differ is that Ptolemy specifies that it is the «locations», τόποι, of these movements that are unclear, while Cleonides does not. I am not sure whether this addition should be reckoned substantial; it could be interpreted in any of several ways. But in any case it seems fairly clear that the two writers have drawn this part of their accounts from the same tradition, one that does not go back to Aristoxenus himself.

Aristides and Bacchius take the shift away from Aristoxenus a step further. According to Aristides, «continuous vocal sound is that which makes its descents and ascents obscurely (λεληθότως) because of their rapidity» (5, 26-6, 2 Winnington-Ingram), and he goes on to say that it is the mode of utterance that we use when we talk (6, 4). Apart from the allusion to rapidity, τάχος, to which I'll return later, this gives exactly the same picture of continuous movement as the first part of Cleonides' statement, but it entirely omits its second, authentically Aristoxenian element. Bacchius, in his question-and-answer format, uses quite different phrasing and does not even include the word «continuous», and he implicitly conveys a new point which is clearly important; but he too has abandoned Aristoxenus. He has just explained that φθόγγοι, notes, fall into two classes, ἑμμελεῖς and πεζοί, those that are melodic and those used in speech; and throughout the passage the subjects under discussion are notes. Melodic notes are defined first, and then the instructor asks: «And

which are the πεζοί?» The response is: «They are those which the orators use and which we ourselves use when we talk to one another. And melodic notes have determinate intervals (ὠρισμένα διαστήματα), while the πεζοί have indeterminate ones (ἀόριστα)» (Bacch. *Harm.* 69, 307, 5-14 Jan)¹¹.

Neither Aristides nor Bacchius presents the Aristoxenian picture of a sound that moves continuously throughout its duration. Both focus exclusively on the perceptual obscurity or indeterminacy of its movements between pitches, and they neither assert nor imply that the sound includes no stable pitches between which the movements take place. Further, if we take seriously – as I think we should – the fact that the heading under which Bacchius discusses the matter is that of φθόγγοι, «notes», and that what he is trying to define are φθόγγοι πεζοί, «the notes used in speech», it is plainly implied that there are indeed such moments of stability. He has just defined a φθόγγος as φωνῆς στάσις ἐπὶ μίαν πτῶσιν μέλους, «the voice's standstill on one πτῶσις of melody» (Bacch. *Harm.* 67, 306, 19-20), where the noun πτῶσις must refer to what Aristoxenus describes, more fully, as «the incidence (πτῶσις) of the voice on one pitch»¹². Then what Bacchius describes as ἀόριστα, «indeterminate», are the intervals between pitches upon which the speaking voice remains stable, pitches which can therefore be described as «notes».

¹¹ Here is the complete passage.

Φθόγγων δὲ πόσα λέγομεν εἶναι γένη; – Δύο. τούτων δὲ οὓς μὲν ἐμμελεῖς καλοῦμεν, οὓς δὲ πεζούς.

Ἐμμελεῖς ποῖοι εἰσιν; – Οἷς οἱ ᾄδοντες χρώνται καὶ οἱ διὰ τῶν ὀργάνων τι ἐνεργοῦντες. τούτου γὰρ μὴ ὑπάρχοντος ἀδύνατόν τι τῶν κατὰ μουσικὴν δεῖξαι.

Πεζοὶ δὲ ποῖοι εἰσιν; – Οἷς οἱ ῥήτορες χρώνται καὶ οἷς αὐτοὶ πρὸς ἀλλήλους λαλοῦμεν. καὶ οἱ μὲν ἐμμελεῖς ὠρισμένα ἔχουσι τὰ διαστήματα, οἱ δὲ πεζοὶ ἀόριστα.

How many kinds of notes do we say there are? – Two. We call some of them 'melodic' (*emmeleis*) and some of them characteristic of speech (*pezoi*).

Which are the melodic notes? – Those used by people who are singing or making sounds by means of instruments. For if this attribute is missing it is impossible to produce anything musical.

And which are those characteristic of speech? – They are those which the orators use and which we ourselves use when we talk to one another. And melodic notes have determinate intervals, while those characteristic of speech have indeterminate ones.

¹² ARISTOX. *Harm.* 20, 16-17; cf. PORPH. in *Harm.* 86, 8-10.

Let's turn finally and briefly to the one literary theorist I want to consider, Dionysius of Halicarnassus, who discusses the «melody», μέλος, of spoken language and contrasts it with that of music in section 11 of his *De compositione verborum*. Having said something about the distances separating the pitches between which the speaking voice moves, he continues as follows. «But the whole utterance during one part of a *logos* [that is, during the utterance of a single word] is not placed (ταττομένη) and spoken on the same pitch throughout, ἐπὶ τῆς αὐτῆς τάσεως, but one syllable is on the high pitch (ἐπὶ τῆς ὀξεύας), another on the low pitch (ἐπὶ τῆς βαρείας), another on both (ἐπ' ἀμφοῖν)» (Dion. Hal. *De comp. verb.* 11, 77-79). The words I want to draw attention to here are ταττομένη, «placed», and the little preposition introducing the phrases governed by it, ἐπὶ. I don't think that there is anything ambiguous about these words' implications. The syllables of spoken language are placed either on (ἐπὶ) a high pitch or on a low pitch, or else they shift between two (and only two) points of pitch while they are being uttered (these are of course the syllables marked with a circumflex accent). The description seems to fit perfectly into the picture presented by Porphyry in the passages I have discussed, into the part of Cleonides' definition which does not come from Aristoxenus, into the account given by Aristides Quintilianus, and very clearly into the one given by Bacchius. Putting their accounts together, we can conclude that in enunciating a word, the word μουσική, for instance, to take a simple example, a Greek speaker would produce each syllable on a sustained and determinate pitch for part of its duration, perhaps for most of it, but would slide «indeterminately» from one pitch to another in the phases towards the end of one syllable and at the beginning of the next.

The difference between this mode of speech and the one described by Aristoxenus is striking; and if we exclude the possibility that one or other of the groups of writers I've mentioned was simply wrong, we seem to be faced with the conclusion that the way in which Greek was spoken changed, in the relevant respect, at a time between the late fourth century BC and the time of Dionysius of Halicarnassus in the first¹³. Perhaps it

¹³ If the indications in Dionysius are thought to be too slight to carry conviction, the time-span within which the change would have taken place will expand. We can then only say that it happened, if it did, at some time in the long period between Aristoxenus in the fourth century BC and Porphyry in the third century AD.

did. But I must now mention a powerful objection to this hypothesis; and I must also introduce the fourth possible explanation of the difference between Aristoxenus' account and those of the later writers. I owe both the objection and the explanation to the detailed comments on this paper offered by an anonymous reviewer, for whose help I am extremely grateful, but who should not be held responsible for the way I have formulated them.

The objection is straightforward. According to Aristoxenus, the speaking voice is constantly shifting in pitch, while according to the later writers it comes briefly to rest on a stable pitch for some part of each syllable's duration. But we know that Greek in the time of Aristoxenus was a tonal language, and gradually lost its tonal features during the centuries around the late Hellenistic period and the early Roman empire. Eventually, around 200 AD, the written pitch-accent was abandoned¹⁴. It would therefore be very strange if the pitch-profile of the spoken language became more clear-cut in the course of the period between the fourth century BC and the first, as the evidence of the later theorists apparently suggests. This strikes me as a cogent (if perhaps not conclusive) objection to the hypothesis that the difference between the accounts of Aristoxenus and the later writers directly reflects a change in the way the language was spoken.

The alternative hypothesis begins from the observation that when the pitch of a syllable varies continuously but over a small range, listeners will typically perceive it as having a constant pitch at some point within that range. «Provided the magnitude of a frequency change and the duration of the transition are not too large, a single unchanged pitch will be attributed to a vowel having continuously rising or falling fundamental frequency. According to one study, if the fundamental frequency excursion was less than about 2,5 semitones, a single pitch was assigned to the vowel corresponding to the frequency approximately two-thirds of the way into the excursion»¹⁵. But this is true only of 'normal' listeners, a category to which Aristoxenus seems not to belong. To judge by his insistence on the

¹⁴ See e.g. M.L. WEST, *Greek Metre*, Oxford 1982, p. 163.

¹⁵ A.M. DEVINE, L.D. STEPHENS, «TAPhA», 121, 1991, p. 241, and cf. *ibid.*, *The Prosody of Greek Speech*, New York 1994, p. 160 (this book is the fundamental modern study of the characteristics of spoken Greek).

importance of ‘training the ear to accuracy’¹⁶, and the minute differences he identifies between intervals in various forms of musical scale, we may reasonably assume that he had taught himself to attend unusually closely to tiny nuances and variations of pitch; and we may assume, too, that he would have brought the same sophisticated skill to his examination of the spoken language. Perhaps the later writers had not trained their powers of auditory discrimination to the same extent. If that were so, there is a sense in which the two accounts could both be correct: Aristoxenus may give us an accurate description of the real pitch-profile of spoken Greek, but the others may nevertheless have been accurately describing the form in which it presented itself to the ears of ordinary listeners. Their apparent disagreement with Aristoxenus might not, in fact, be due to their relative incompetence as listeners. If their engagement with the theoretical or scientific issues was connected with an interest in the practicalities of public speaking and musical performance, they will have had good reasons for focusing on the features which speech and song presented to people in general – that is, to members of an orator’s or a musician’s typical audience – rather than on features which were accessible only to experts. Observations which I offer below suggest quite strongly that they were indeed concerned with these practical matters. I now think that this diagnosis of the situation is likely to be correct, or nearly so, but it calls for fuller consideration and research than I have yet been able to give it.

I would like to end with one further question: Who was responsible for introducing into *musical* theory these modifications of Aristoxenus’ account? The answer seems to be both clear and vague, clear in that we can attach a label to the sources in question, and vague because we cannot name them or assign them a definite date. We can pick up the essential clue from an ingredient that appears in both Aristides Quintilianus and Porphyry. As I noted above, Aristides says that the ascents and descents of continuous vocal sound are obscure «because of their rapidity», τάχος. Aristoxenus says nothing like this, and I am confident that he would have found the reference to rapidity inappropriate in this context. The difference he identifies between intervallic and continuous vocal movement is independent of the speeds at which each of them travels across the dimension of pitch. But it is a prominent feature of the account given in a passage of Porphyry at *Harm.* 9, 34–10, 27, much earlier in the

¹⁶ See especially ARISTOX. *Harm.* 42, 10–43, 2.

text than the ones we have considered, in which he is expounding the views of «the Aristoxenians» on these matters. This account has several unusual features, one of which is the heavy emphasis it places on the great speed with which spoken language moves from pitch to pitch. Such rapid transitions, it says, are entirely out of place in music, and people who try to sing very fast, thinking that is a sign of technical excellence, are badly mistaken; the truth is that their performances are disgraceful, since they are giving a characteristic to song which in fact belongs to speech.

There is no reason to doubt that these and other strange features of the passage are due to Aristoxenians, as Porphyry says, and we have seen that the allusion to the speed of transition between pitches reappears in Aristides Quintilianus. In his treatment, he couples it with his focus on the obscurity of these transitions, and he says nothing to suggest that the pitches themselves are indistinct. The references to speed in these passages are unusual, and their correspondence offers reasonable (though of course not conclusive) grounds for the hypothesis that the picture we detected in Porphyry's treatment of the rainbow and his later remarks on speech, and found again in Bacchius and in Dionysius of Halicarnassus, entered the domain of musical theory from Aristoxenian sources. Evidently the Aristoxenians in question must have come from a time after Aristoxenus himself, and we cannot name them, since when later Aristoxenians are mentioned in surviving texts they are always anonymous. I have argued elsewhere that they were not writers but teachers, both those who taught in schools, and professional musicians who trained young apprentices in the mysteries of their art¹⁷; but I cannot pursue that question here. The essential point I have been trying to make is that the musical theorists' conception of the profile of speech, and hence also of the relation between speaking and singing, did not remain fixed in the form attributed to it by Aristoxenus. And if this is the case, it may have consequences for our investigations into an obscure and closely related topic, the mode of delivery, to which several writers refer, which falls into the shadowy region between speech and song, and between intervallic and continuous vocal movement. If Greek musical theorists' conception of the movement of the speaking voice changed over time, and thereby altered the way in which they took it to differ from that of the singing voice, their conception of this «intermediate» form of

¹⁷ In an unpublished paper presented at a conference in Berlin in November 2011.

delivery can hardly have remained unaffected. At the very least, this is a possibility which scholars who study the matter should take seriously into consideration.